



## Original article

# The effect of a 'fast-track' unit on the performance of a cardiothoracic department

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**Objective:** The objective of this study was to describe the impact of a 'fast-track' unit, combined with a computerised system for information collection and analysis, on the clinical practice and finance of a cardiothoracic department over the first 12 month period of its application.

**Methods:** Within 12 months, starting December 1996, 642 major cardiothoracic cases were performed at the Cardiothoracic Department, St Mary's Hospital, London, after the establishment of a 3-bed 'fast-track' unit, which was supported by a computerised system for admission planning and a pre-admission clinic. The main outcome measures were operating numbers, financial income, patient recovery and operative mortality.

**Results:** The 'fast-track' unit resulted in an increase of the operating numbers (11.3% increase in major cardiac cases) and income (38%), as compared with the year before. Some 525 patients out of 642 (81.8%) were scheduled for the 'fast-track' unit and 492 (93.7%) were successfully 'fast-tracked'. Coronary artery bypass grafting operations had the lowest 'fast-track' failure and mortality rates. Re-do operations and complex coronary procedures presented a high 'fast-track' failure rate of approximately 20–25%. Low cardiac output, postoperative bleeding and respiratory problems were the most frequent causes for 'fast-track' failure.

**Conclusions:** The development of a 'fast-track' unit, supported by a computerised system for information collection and analysis and a pre-admission clinic, has resulted in a substantial improvement of operating numbers and financial income, without adversely affecting the clinical results. This task demanded close collaboration between a dedicated list manager and a designated member of the medical team. Patient selection with appropriate 'fast-track' criteria may improve further the efficiency of 'fast-track' units in the future.

**Key words:** Fast-track – Recovery – Extubation – Cardiopulmonary bypass

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Rapid changes in the structure of the British National Health Service (NHS) have made management a complicated issue. This is particularly true for cardiothoracic surgery, the nature of which demands not only a high standard of surgical skills, but also close collaboration between departments.

Before December 1996, the infrastructure of the Cardiothoracic Department included 22 ward beds, 6 high dependency unit (HDU) beds, 4 intensive therapy unit (ITU) beds loosely allocated to cardiothoracic surgery and two operating theatres providing 18 NHS sessions per week. In 1996, the number of non-cardiothoracic admissions to the ITU increased, affecting the availability of ITU beds for cardiothoracic patients. This resulted in an 11.4% reduction in our operating numbers and financial under-performance. At the same time, poor organisation of the waiting list contributed to the financial under-performance.

In November 1996, a number of measures were undertaken to improve both the clinical service and the financial performance. These measures included: (i) establishment of a 'fast-track' unit; (ii) a computerised system for information collection and analysis for admission planning; and (iii) establishment of a pre-admission clinic. In February 1997, a list manager was employed to plan operating lists, taking into account medical information, waiting-list times and finance. Since 1st December 1996, we have audited the operating performance and the finance, along with the clinical results.

We describe the impact of the aforementioned measures on the clinical practice and finance of the Cardiothoracic Department over the first 12 months of their application.

## Patients and Methods

Between 1st December 1996 and 30th November 1997 (12 months), we performed 642 major cardiac cases. Data were collected by recording information available from daily ward rounds, medical and nursing reports, out-patient clinic, theatre registers, perfusion records and 'fast-track' and ITU admission books.

### *'Fast-track unit'*

The 'fast-track unit' was designed to admit patients post-cardiac surgery, scheduled to be extubated within 6 h of admittance and discharged to HDU within 4–12 h, avoiding ITU admission. All cardiac cases were scheduled to the either 'fast-track' area or the ITU. Guidelines for patient exclusion from 'fast-track' recovery are presented in Table 1. (Note: in the British

NHS there are three types of referrals. 'Block contracts' impose an upper limit on the number of cases per year. Exceeding the agreed number of cases results in financial losses. General Practitioner Fund Holders [GPFH] and extra-contract referrals [ECR] do not impose limits on the number of cases per year.) Initially, re-do operations and complex coronary procedures were not included in the exclusion criteria, but they were added throughout the application of the programme, as a result of a high rate of unsuccessful 'fast-tracking' of these cases.

The 'fast-track' unit consisted of three beds with the capacity for ventilation, and conventional postcardiac surgery monitoring (intra-arterial blood pressure, central venous pressure, heart rate, urine output and arterial blood gases). Patients who developed serious intra-operative problems (*i.e.* haemodynamic instability, serious coagulopathy, *etc.*) and those who failed to meet the criteria for extubation (Table 2) on the first postoperative day were transferred to the ITU. In the unusual case where no ITU beds were available, the patient stayed in the 'fast-track' area until an ITU bed became available. Patients undergoing major thoracic procedures were admitted to the general recovery area.

### *List management – pre-admission clinic*

The computerised waiting list was planned to include medical and nursing information, referral status, expected recovery ('fast-track' or ITU), and waiting-list time. The medical and nursing information, as well as the expected recovery status were retrieved from the pre-admission clinic and referral letters. All patients, except the in-hospital referrals and emergency cases, attended this clinic. More specifically, this clinic included medical history and physical examination, nursing, physiotherapy and cardiac rehabilitation approach and blood profile, group and save, ECG and chest X-ray. The information was passed to the list manager and added to the computerised waiting list.

The medical and nursing information from the pre-admission clinic was combined with the expected status of recovery, the type of referral, the time in the waiting list and other relative information (staff holiday, meetings, *etc.*) in order to provide the best mix of patients for the operating list.

### *Definitions*

The index for operating performance was the number of cardiac cases performed. Thoracic cases were not included. 'Long stay in fast-track unit' was defined as any 'fast-track' case which needed to stay in the unit

Table 1 Guidelines for exclusion patients from 'fast-track' recovery

Initial criteria	Modified criteria
Age > 80 years	Age >80 years
Need for inotropic support $\pm$ IABP before the operation	Need for inotropic support $\pm$ IABP before the operation
<b>Operation</b>	<b>Operation</b>
Ascending aorta and arch operations <sup>†</sup>	Re-do operation Complex cardiac procedure* Ascending aorta and arch operations <sup>†</sup>
<b>Associated diseases</b>	<b>Associated diseases</b>
COAD/chronic pulmonary insufficiency Chronic renal failure on dialysis	COAD/chronic pulmonary insufficiency Chronic renal failure on dialysis

\*Combination of: (i) CABG and valve procedure; (ii) CABG and left ventricular aneurysmectomy; (iii) CABG and carotid endarterectomy; and (iv) double valve procedure (aortic and mitral / mitral and tricuspid valves).

<sup>†</sup>Aortic root replacement or dissecting aortic aneurysm repair.

IABP, intra-aortic balloon pump; COAD, chronic obstructive airways disease; CABG, coronary artery bypass grafting.

Table 2 Criteria for extubation<sup>1</sup>

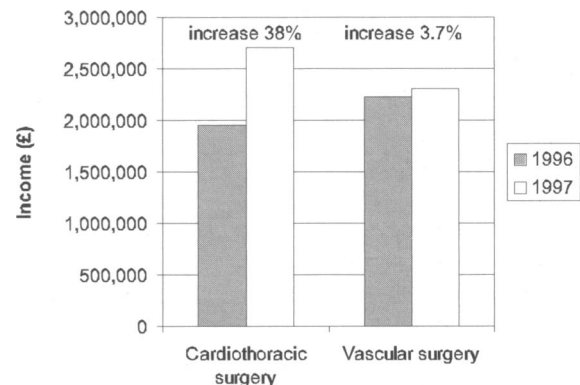
1.	Patient awake and alert, indicating recovery from anaesthesia and ability to protect his or her airway
2.	Satisfactory haemodynamic state
3.	Absence of important bleeding from chest tubes
4.	Arterial PO <sub>2</sub> $\geq$ 10 kPa (in the absence of intracardiac right-to-left shunting) on IMV of 6 breaths/min and FiO <sub>2</sub> of 40%
5.	Spontaneous respiratory rate < 25 breaths/min
6.	Absence of increased work of breathing (use of accessory respiratory muscles)
7.	Normal PaCO <sub>2</sub> $\geq$ 6.5 kPa
8.	Absence of significant metabolic acidosis pH $\geq$ 7.30

for more than 24 h, for medical reasons in the context of unavailability of ITU beds. 'Fast-track' failure was defined any case scheduled for the 'fast-track' unit which needed ITU care.

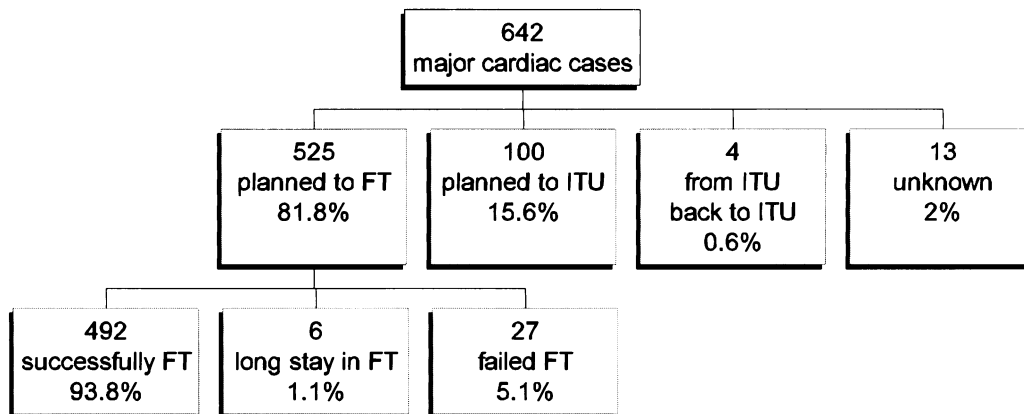
## Results

### Operating and financial performance

Without changing the criteria for operation, the 'fast-track' unit resulted in a recovery of the operating performance. There was an 11.5% increase in major cardiac cases compared to the year before (572 cardiac cases in 1995/1996 versus 638 in 1996/1997). There were no changes in the clinical priorities since there were 6.2% (35/572) urgent cases in 1995/1996 versus 5.8% (37/638) in 1996/1997. The 'fast-track' unit, supported by a computerised waiting list and pre-admission clinic resulted in a remarkable improvement of the Cardiothoracic Department income (Fig. 1). A comparison of the finance between cardiothoracic surgery and another major surgical department is also presented in the same



**Figure 1** The effect of a 'fast-track' unit on the financial performance of a Cardiothoracic Department. The establishment of a 'fast-track' unit, supported by a computerised waiting list and a pre-admission clinic resulted in a remarkable income increase. A comparison of the finance between cardiothoracic surgery and another major surgical department is also presented in the same figure. The application of the new management strategy resulted in a 38% increase in income in the cardiothoracic department, compared to only 4% income increase in the other major surgical department



**Figure 2** Presentation of the recovery status of major cardiac cases after the establishment of a 'fast-track' unit. FT, 'fast-track'; ITU, intensive care unit

**Table 3** 'Fast-track' rate of failure and mortality in different operations

Operation	'Fast-track' failure rate	Mortality (30 day)
CABG	4.5% (20/447)	1.5% (7/447)
AVR or MVR	11.4% (5/44)	4.5% (2/44)
Re-do operation (CABG or AVR or MVR)	21.4% (3/14)	0% (0/14)
Complex cardiac procedures*	25% (4/16)	0% (0/16)
ASD closure	0% (0/3)	0% (0/3)
Thoracic**	100% (1/1)	100% (1/1)
Total	6.3% (33/525)	1.9% (10/525)

\*AVR + CABG 6, MVR + CABG 4, CABG + left ventricular aneurysmectomy 3, CABG + carotid endarterectomy 1, AVR + MVR 1, MVR + TVR 1.

\*\*Resection of thoracic tumour invading the heart.

CABG, coronary artery bypass grafting; AVR, aortic valve replacement; MVR, mitral valve replacement/repair; ASD, atrial septal defect; TVR, tricuspid valve repair.

**Table 4** Reasons for 'fast-track' failure

Low cardiac output	27%	(9/33)
Postoperative bleeding	18%	(6/33)
Respiratory problems	15%	(5/33)
Arrhythmias	9%	(3/33)
Long cardiopulmonary bypass time	6%	(2/33)
Protamine reaction	3%	(1/33)
Aortic perforation (during aortic cannulation)	3%	(1/33)
Difficult ET intubation	3%	(1/33)
ET bleeding (following ET intubation)	3%	(1/33)
ECG changes on induction of anaesthesia	3%	(1/33)
Clot in cardiopulmonary bypass circuit	3%	(1/33)
Unknown	6%	(2/33)

ET, endotracheal.

figure. The application of the new management strategy resulted in a 38% increase in income in the cardiothoracic department, compared to only 4% income increase in the other major surgical department under the same directory.

#### Recovery after major cardiac operations

The patient recovery status after major cardiac operations is presented in Figure 2. Out of 642 patients, 525 (81.8%) were scheduled for the 'fast-track' unit and 492 (93.7%) were successfully 'fast-tracked'. Four cases came from the ITU before the operation and returned to ITU after the operation. Table 3 shows the 'fast-track' failure and mortality rate per operation. Coronary artery

bypass grafting cases had the lowest 'fast-track' failure and mortality rates. Re-do operations and complex coronary procedures were not initially excluded from the 'fast-track' unit; however, they presented a high 'fast-track' failure rate of approximately 20–25%. This resulted in a modification of the guidelines for exclusion patients from 'fast-track' recovery (Table 1). Notably, the mortality rate in these two groups was 0%.

The reasons for 'fast-track' failure are summarised in Table 4. Low cardiac output, postoperative bleeding and respiratory problems were the three most frequent causes for 'fast-track' failure.

#### Discussion

These results show an improvement in the operating numbers since the setting up of the 'fast-track' unit, as

compared with the previous 12 months, without any change in the criteria for operation and clinical priorities. Since the major cause for under-performance in 1995/1996 was the limitations in ITU beds, the initial idea was simply to bypass the ITU by using a 'fast-track' unit. However, we soon realised that 'fast-tracking' patients required a substantially different surgical, anaesthetic and nursing approach. The cornerstone of 'fast-tracking' is the early extubation after cardiac surgery. The prerequisites for early extubation are patients to be relatively young and healthy with good pre-operative cardiac, respiratory and renal functions, rapid recovery from anaesthesia and operation to be quick and uncomplicated with short bypass time.

In order to select patients fulfilling the 'fast-track' criteria it was imperative to examine them before admission. This task was undertaken in the pre-admission clinic, which was organised on a weekly or a fortnightly base. In the outpatient clinic, we collected information considered to be important for 'fast-tracking', prepared the patients for the experience of 'fast-tracking' (*i.e.* effort to keep breathing and possible higher levels of pain after early extubation, *etc.*), and warned them that they would be shortly called for admission (1–15 days). Blood group and safe was obtained in order to minimise blood availability problems. Also, additional investigations which might delay the operation (*i.e.* carotid dopplers in the presence of carotid bruits) were organised in an outpatient basis. Admittedly, many of these tasks could be done in a routine outpatient's clinic. However, many patients in our list had been seen at the outpatient clinic long before the initiation of the 'fast-track' programme.

For the application of a 'fast-track' programme, we felt that surgery needed to be quicker and, therefore, it was performed by more experienced surgeons. Changes in the anaesthetic approach included lighter anaesthesia, especially during the last 60 min of the operation in order to achieve early extubation. Before starting the 'fast-track' programme, the surgical team requested the establishment of a common anaesthetic protocol, compatible with early extubation; however, all six anaesthetic consultants felt unhappy to change their anaesthetic practices and rejected this proposal. Alternatively, they all agreed to apply lighter anaesthesia towards the end of the operation. Although, it may sound a limitation to the study, we feel that it strengthens the power of the fast-track criteria we used. It may indicate that 'fast-tracking' is not significantly dependent on a particular type of anaesthesia, but it can be more broadly applicable. Changes in the nursing approach included: (i) information and psychological preparation of patients for early extubation; (ii)

familiarity with respiratory support after early extubation and use of inotropic drugs; (iii) familiarity with more aggressive analgesia; and (iv) familiarity with haemodynamic monitoring.

A revision of the operating and financial performance of the Cardiothoracic Department in 1996/1997 showed a mismatch between operating numbers and income. In other words, the variation in operating numbers did not follow the variation in income. The reason was that patients fell in two financial groups, namely the 'block-contract group' and the 'GPFH/ECR group'. The disproportional improvement in financial performance has resulted from a more appropriate mix of contract patients and a more organised approach to the management of the waiting list. The improvement of the financial performance did not seem to be incidental, because it did not occur in another major surgical department of the same hospital during the same period of time.

The information needed to organise an operating list seemed to exceed the skills of an ordinary doctor or nurse. It also seemed to be difficult even for a non-medical fully dedicated person. The reason was the complicated and rapidly changing information which defined the best mix of the patients for the desired triad – maximum operating numbers, maximum income, good clinical results. There are two major subsets of information that should be available, the 'medical-nursing information' and the 'financial-contract information'. The first defines the recovery status of the patients ('fast-track' or non-'fast track'). The second defines the number and mix of patients from different block-contracts (not to exceed the defined level) and the number of GPFH/ECR patients. In order to achieve the best mix of patients, a continuous communication and interaction should be established between a designated medical person supervising the pre-admission clinic and the list manager.

The 'fast-track' programme was successful and has released the pressure on ITU beds. Only 15.6% (100/642) of the major cardiac cases were scheduled for the ITU and an additional 4.2% (27/625) were failed 'fast-track' patients who ended up in the ITU. In absolute numbers approximately 10–11 patients per month (2–3 per week) required an ITU bed. The 'fast-track' failure rate (6.3%, 33 out of 525 cases scheduled for the 'fast-track' unit) fell between the 1% reported by Westaby *et al.*<sup>2</sup> and the 15% reported by Cheng *et al.*<sup>3</sup> Application of the modified guidelines for exclusion patients from 'fast-track' recovery, as presented in Table 1, are expected to further reduce the 'fast-track' failure rate. 'Fast-track' recovery did not result in a mortality rate outside the internationally accepted range, although risk-adjusted mort-

ality might have been a more appropriate tool for comparisons.

In conclusion, the development of a 'fast-track' unit, supported by a computerised waiting list and a pre-admission clinic, has resulted in a substantial improvement of operating numbers and financial income, without adversely affecting the clinical results. This task demanded close collaboration between a dedicated list manager and a designated member of the medical team. Establishment of appropriate 'fast-track' criteria for patient selection may improve further the efficiency of 'fast-track' units in future.

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